FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE: PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: **R.36040-1**

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): **10/019020**

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE 00/01877	**08 June 2000**	**22 June 1999**

TITLE OF INVENTION

APPARATUS FOR METERING A REDUCING AGENT

APPLICANT(S) FOR DO/EO/US

FRISCH, Walter HUBER, Sven KRAH, Juergen MAYER, Hanspeter OFFENHUBER, Michael SACHSENHOFER, Robert WEISS, Roland FOETSCHL, Markus SCHWARZ, Roland

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☒ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☒ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Transmittal Sheets in duplicate w/fees charged to Dep.Acct. 07-2100; Copy of German Text Appl w/5 sheets drawings; Copy of German Text Amended Pages; Translation of German Text Appl. w/5 sheets drawings and translation of German Text Amended Pages; Copy of PCT/RO/101, PCT/ISA/210/220; PCT/IPEA/401/409; Preliminary Amendment; Executed Declaration and Assignment to Robert Bosch GmbH (not enclosed)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/019020	PCT/DE 00/01877	R.36040-1

24. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**	
☒	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**	
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**	
☐	International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**	
☐	International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**	
	ENTER APPROPRIATE BASIC FEE AMOUNT =	**$890.00**
	Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$130.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	12 - 20 =	0	x $18.00	**$0.00**	
Independent claims	- 3 =	0	x $84.00	**$0.00**	
Multiple Dependent Claims **(check if applicable).**			☐	**$0.00**	
		TOTAL OF ABOVE CALCULATIONS =		**$1,020.00**	
☐	Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.			**$0.00**	
		SUBTOTAL =		**$1,020.00**	
	Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).		+	**$0.00**	
		TOTAL NATIONAL FEE =		**$1,020.00**	
☐	Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			**$0.00**	
		TOTAL FEES ENCLOSED =		**$1,020.00**	
				Amount to be: refunded	$
				charged	$

a. ☐ A check in the amount of _____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. **07-2100** in the amount of **$1,020.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **07-2100** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE
Reg # 20893

Ronald E. Greigg
NAME

31,517
REGISTRATION NUMBER

26 December 2001
DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Walter Frisch et al

Based on PCT/DE 00/01877

For: Apparatus For Metering A Reducing Agent

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION

Page 1, between the title and paragraph [0001], insert the following:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS

[0000.4] This application is a 35 USC 371 application of PCT/DE 00/01877 filed on June 8, 2000.

[0000.6] BACKGROUND OF THE INVENTION

[0000.8] Field of the Invention

replace paragraph [0001] with the following amended paragraph:

[0001] The present invention relates to an apparatus for metering a reducing agent, in particular a urea or a urea- water solution, in the context of catalytic exhaust gas posttreatment.

after paragraph [0001], insert the following new paragraph:

[0001.5] Description of the Prior Art

Page 2, replace paragraph [0004] with the following new paragraph:

[0004] From European Patent Disclosure EP-A 0 381 236, a system is known that, to remove nitrogen oxides in exhaust gases from a Diesel engine, meters in ammonia as a reducing agent. In this system, a turbocharger is also provided, which lowers the pressure of the exhaust gas. A urea-water solution used is metered in by means of compressed air.

Page 3, delete paragraph [0009];

Page 4, replace paragraph [0011] with the following amended paragraph:

[0011] Reducing the structural size also leads to a reduction in idle volumes in the reducing agent delivery line. A block provided according to the invention is also mechanically more stable than a reducing agent metering system constructed of pipes and screw connections. By reducing the number of screw connection points, with the resultant smaller number of sealing points, better tightness overall is attained. A plastic or metal block can be furnished substantially less expensively than a system that uses screw connections and pipelines.

delete paragraph [0013];

Page 6, replace paragraph [0020] with the following amended paragraph:

[0020] The apparatus according to the invention will now be described in further detail in conjunction with the accompanying drawings, in which:

Page 7, replace paragraph [0021] with the following amended paragraph:

[0021] Fig. 1 is a block circuit diagram of a urea metering system, which according to the invention is at least partly secured to or integrated with a central plastic block;

replace paragraph [0022] with the following amended paragraph:

[0022] Fig. 2 is a perspective view of a preferred embodiment of the metering system of the invention;

replace paragraph [0023] with the following amended paragraph:

[0023] Fig. 3 is a sectional view of a further preferred embodiment of the urea metering system of the invention;

replace paragraph [0024] with the following amended paragraph:

[0024] Fig. 4 is a further sectional view of the embodiment of Fig. 3, taken along the line K-K; and

replace paragraph [0025] with the following amended paragraph:

[0025] Fig. 5 is a schematic perspective view of a preferred embodiment of the electrically conductive plastic block used according to the invention.

after paragraph [0025], insert the following new paragraph:

[0025.5] DESCRIPTION OF THE PREFERRED EMBODIMENTS

Page 11, after paragraph [0036], insert the following new paragraph:

[0037] The foregoing relates to preferred exemplary embodiment of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.

Page 12, delete "Claims" and insert --We Claim--.

IN THE CLAIMS

Please cancel claims 1-5 and add new claims 8-19.

8. An apparatus for metering a reducing agent, in particular a urea or a urea-water solution, comprising means (20a, 20b, 21, 22, 23, 55) for air delivery into a mixing chamber (8), means (1a, 2, 3, 4, 5, 6) for metered reducing agent delivery into the mixing chamber (8), means (8a) for forming an aerosol using the components delivered to the mixing chamber (8), and means for metered dispensing of the aerosol into an aerosol line (25), the means (20a, 20b, 21, 22, 23, 55) for the air delivery, the means (1a, 2, 3, 4, 5, 6) for the metered reducing agent delivery, and the mixing chamber (8) all being secured to or integrated in a block (60) of an electrically conductive plastic, the air delivery being meterable.

9. The apparatus of claim 8, wherein the block (60) is produced from a plastic to which electrically conductive particles are added.

10. The apparatus of claim 8, wherein the block (60) is embodied with electrodes (160) that can be subjected to a voltage.

11. The apparatus of claim 9, wherein the block (60) is embodied with electrodes (160) that can be subjected to a voltage.

12. The apparatus of claim 8, wherein the means for air delivery comprising an air medium delivery line (20a), an air pressure regulating valve (22), an air pressure sensor (55), a check valve (23), and a metering valve (7).

13. The apparatus of claim 9, wherein the means for air delivery comprising an air medium delivery line (20a), an air pressure regulating valve (22), an air pressure sensor (55), a check valve (23), and a metering valve (7).

14. The apparatus of claim 10, wherein the means for air delivery comprising an air medium delivery line (20a), an air pressure regulating valve (22), an air pressure sensor (55), a check valve (23), and a metering valve (7).

15. The apparatus of claim 11, wherein the means for air delivery comprising an air medium delivery line (20a), an air pressure regulating valve (22), an air pressure sensor (55), a check valve (23), and a metering valve (7).

16. The apparatus of claim 8, wherein the means for reducing agent delivery have a reducing agent delivery line (1a), a pump (4), a pressure regulator (10), a pressure damper (5), a metering valve, and at least one check valve (2).

17. The apparatus of claim 9, wherein the means for reducing agent delivery have a reducing agent delivery line (1a), a pump (4), a pressure regulator (10), a pressure damper (5), a metering valve, and at least one check valve (2).

18. The apparatus of claim 10, wherein the means for reducing agent delivery have a reducing agent delivery line (1a), a pump (4), a pressure regulator (10), a pressure damper (5), a metering valve, and at least one check valve (2).

19. The apparatus of claim 12, wherein the means for reducing agent delivery have a reducing agent delivery line (1a), a pump (4), a pressure regulator (10), a pressure damper (5), a metering valve, and at least one check valve (2).

IN THE ABSTRACT

Please substitute the attached Abstract of the Disclosure for the abstract as originally as filed.

REMARKS

The above amendments are being made to place the application in better condition for examination.

Entry of the amendment is respectfully solicited.

Respectfully submitted,

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Page 14, replace the abstract for the following amended abstract:

Abstract of the Disclosure

An apparatus for metering a reducing agent, in particular a urea or a urea-water solution, having means for metered air delivery into a mixing chamber, means for metered reducing agent delivery into the mixing chamber, means for forming an aerosol using the components delivered to the mixing chamber, and means for metered dispensing of the aerosol into an aerosol line, in which the means for the metered air delivery, the means for the metered reducing agent delivery, and the mixing chamber are all secured at least partly to a block of a plastic or a metal material or are integrated with it.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Page 1, paragraphs [0000.2] through [0001.5]:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS

[0000.4] This application is a 35 USC 371 application of PCT/DE 00/01877 filed on June 8, 2000.

[0000.6] BACKGROUND OF THE INVENTION

[0000.8] Field of the Invention

[0001] The present invention relates to an apparatus for metering a reducing agent, in particular a urea or a urea- water solution, in the context of catalytic exhaust gas posttreatment[, as generically defined by the preamble to claim 1].

[0001.5] Description of the Prior Art

Page 2, paragraph [0004]:

[0004] From European Patent Disclosure EP-A 0 381 236, a system is known that, to remove nitrogen oxides in exhaust gases from a Diesel engine, meters in ammonia as a reducing agent. In this system, a turbocharger is also provided, which lowers the pressure of the exhaust gas. A urea-water solution used is metered in by means of compressed air.

Page 3, paragraph [0009];

[0009] [This object is attained by an apparatus having the characteristics of claim 1.]

Page 4, paragraph [0011]:

[0011] Reducing the structural size also leads to a reduction in idle volumes in the reducing agent delivery line. A block provided according to the invention is also mechanically [stabler] more stable than a reducing agent metering system constructed of pipes and screw connections. By reducing the number of screw connection points, with the resultant smaller number of sealing points, better tightness overall is attained. A plastic or metal block can be furnished substantially less expensively than a system that uses screw connections and pipelines.

paragraph [0013];

[0013] [Advantageous features of the apparatus of the invention are the subject of the dependent claims.]

Page 6, paragraph [0020]:

[0020] The apparatus according to the invention will now be described in further detail in conjunction with the accompanying [drawing. It shows] drawings, in which:

Page 7, paragraphs [0021] through [0025.5]:

[0021] Fig. 1[,] is a block circuit diagram of a urea metering system, which according to the invention is at least partly secured to or integrated with a central plastic block;

[0022] Fig. 2[,] is a perspective view of a preferred embodiment of the metering system of the invention;

[0023] Fig. 3[,] is a sectional view of a further preferred embodiment of the urea metering system of the invention;

[0024] Fig. 4[,] is a further sectional view of the embodiment of Fig. 3, taken along the line K-K; and

[0025] Fig. 5[,] is a schematic perspective view of a preferred embodiment of the electrically conductive plastic block used according to the invention.

[0025.5] DESCRIPTION OF THE PREFERRED EMBODIMENTS

Page 11, paragraph [0037]:

[0037] The foregoing relates to preferred exemplary embodiment of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.

Page 14, abstract of the disclosure:

Abstract of the Disclosure

An apparatus for metering a reducing agent, in particular a urea or a urea-water solution, having means for metered air delivery into a mixing chamber, means for metered reducing agent delivery into the mixing chamber, means for forming an aerosol using the components delivered to the mixing chamber, and means for metered dispensing of the aerosol into an aerosol line, in which the means for the metered air delivery, the means for the metered reducing agent delivery, and the mixing chamber are all secured at least partly to a block of a plastic or a metal material or are integrated with it.

5/pts

APPARATUS FOR METERING A REDUCING AGENT

[0001] The present invention relates to an apparatus for metering a reducing agent, in particular a urea or a urea-water solution, in the context of catalytic exhaust gas posttreatment, as generically defined by the preamble to claim 1.

[0002] As limit values for pollutants have been set lower and lower in recent years, numerous devices and methods for posttreatment of exhaust gases of internal combustion engines have been developed. For example, efficient exhaust gas posttreatment systems are made available by means of catalytic converter systems that use urea and/or ammonia as reducing agents for NO_x conversion.

[0003] To achieve a reduction of NO_x components in exhaust gases, reducing catalytic converters have been developed especially for Diesel engines; typically, these are subdivided into so-called SCR catalytic converters (for Selective Catalytic Reduction) with urea metering systems, and storage-type catalytic converters. The so-called SCR catalytic converters are regenerated by means of a delivery of urea and/or ammonia reducing agent, while the so-called storage-type catalytic converters are regenerated with hydrocarbons from the entrained engine fuel, in so-called rich exhaust gas phases.

[0004] From European Patent Disclosure EP-A 0 381 236, a system is known that to remove nitrogen oxides in exhaust gases from a Diesel engine meters in ammonia as a reducing agent. In this system, a turbocharger is also provided, which lowers the pressure of the exhaust gas. A urea-water solution used is metered in by means of compressed air.

[0005] From German Patent Disclosure DE-A 44 41 261, a device for posttreatment of exhaust gases of an internal combustion engine is known in which the performance of the catalytic converter is to be improved by way of a metering device. The metering device is embodied as a minimum-quantity metering positive displacement pump, which has a thread course in the form of a groove on a cylindrical body of rotation; to vary the pumping capacity, the body of rotation is driven at a variable rpm. Adding the reducing agent to the exhaust gas system is preferably done as a function of the performance graph, that is, as a function of the quantity and/or composition of the exhaust gas.

[0006] In conventional systems for metering a reducing agent, single components connected in line with one another by modular construction and joined together by hose or pipe connections, are used. One such system is also known from German Patent Disclosure DE 42 30 056 A1.

[0007] Because of the low surface tension of urea or urea solutions, such hose or pipe connections between individual

system components can be sealed off only with major effort, which increases the overall cost of the system. It must be taken into account in particular that a metering system in mobile operation is exposed to oscillating accelerations, which over time can cause poorer sealing characteristics.

[0008] The object of the present invention is therefore to create an apparatus for metering a reducing agent which can be sealed off less expensively than conventional apparatuses.

[0009] This object is attained by an apparatus having the characteristics of claim 1.

[0010] The apparatus according to the invention makes it possible in a simple way to construct a reducing agent metering system that meets the requirements of mobile applications. Oscillating accelerations, which in conventional systems can cause hose and pipe connections to loosen can be effectively avoided or can be limited in their effect. According to the invention, a solid connection between the system components is provided. By securing the components to or integrating them with a plastic or metal block, assembly is simplified. At the same time, the structural size of the apparatus can be reduced compared with conventional apparatuses, since screw connections and lines located in the open can largely be omitted.

[0011] Reducing the structural size also leads to a reduction in idle volumes in the reducing agent delivery line. A block provided according to the invention is also mechanically stabler than a reducing agent metering system constructed of pipes and screw connections. By reducing the number of screw connection points, with the resultant smaller number of sealing points, better tightness overall is attained. A plastic or metal block can be furnished substantially less expensively than a system that uses screw connections and pipelines.

[0012] It furthermore proves to be advantageous that because of the lesser idle volume, which is attainable with the apparatus of the invention, a venting time during which air is transported through the reducing agent lines instead of the reducing agent, can be shortened compared with conventional systems. Also in the apparatus of the invention, a heating capacity to be used for possible thawing after freezing is reduced.

[0013] Advantageous features of the apparatus of the invention are the subject of the dependent claims.

[0014] In a preferred embodiment of the apparatus of the invention, the block is produced from an electrically conductive plastic. With a block embodied in this way, uniform warming or heating of a urea metering system can be attained in a simple way. In conventional systems, which have

many hydraulic or pneumatic lines, heating energy was exerted only at points or over areas, so there was the risk of heat spikes that could be harmful for individual components. Providing an electrically conductive plastic in accordance with the invention also advantageously serves to shield the system electromagnetically and can thus replace a conventional metal housing. The uniform warming that can be attained treats the components gently and makes faster thawing possible, since the heat can be input uniformly over all the hydraulic lines. The shielding properties against electromagnetic radiation provided by the electrically conductive plastic are utilized, as noted, in order to replace a metal housing, since the metal protective properties of such a housing are no longer needed. In this respect, two structural possibilities are in particular conceivable, namely first the embodiment of a plastic block with a control unit placed on it, and on the other a control unit with a surrounding plastic block. An electrically conductive plastic can warm up uniformly over its entire mass.

[0015] Expediently, the plastic block has two electrodes that can be subjected to voltage. The temperature of the plastic block can be controlled in a simple way by way of suitable imposition of a voltage on the electrodes. No additional bores for PTC elements or heating cartridges are needed in the plastic block. Omitting such components makes further cost savings possible. Additional heating coils are also no longer needed in the plastic block.

[0016] In a preferred embodiment of the apparatus of the invention, the block is made from a plastic to which electrically conductive particles are added. By adding electrically conductive particles, the described advantages of an electrically conductive plastic block can be achieved in a simple way.

[0017] In a further preferred embodiment of the apparatus of the invention, the block is produced from aluminum. Such a material is available inexpensively and proves itself sturdy and reliable in practice.

[0018] Expediently, the means for air delivery have an air medium delivery line, an air pressure regulating valve, an air pressure sensor, a check valve, and a metering valve. When these components are used, a desired metered air delivery is controllable in a simple way.

[0019] Expediently, the means for reducing agent delivery have a reducing agent delivery line, a pump, a pressure regulator, a pressure damper, as well as a metering valve and at least one check valve.

[0020] The apparatus according to the invention will now be described in further detail in conjunction with the accompanying drawing. It shows

[0021] Fig. 1, a block circuit diagram of a urea metering system, which according to the invention is at least partly secured to or integrated with a central plastic block;

[0022] Fig. 2, a perspective view of a preferred embodiment of the metering system of the invention;

[0023] Fig. 3, a sectional view of a further preferred embodiment of the urea metering system of the invention;

[0024] Fig. 4, a further sectional view of the embodiment of Fig. 3, taken along the line K-K; and

[0025] Fig. 5, a schematic perspective view of a preferred embodiment of the electrically conductive plastic block used according to the invention.

[0026] The mode of operation and the structure of a reducing agent metering system according to the invention will now be described, taking as an example a urea metering system, as shown in the drawings.

[0027] In Fig. 1, reference numeral 1 indicates a urea tank, from which a urea-water solution is aspirated via a urea line 1a with a check valve 2 and a filter 3, embodied as a filter screen, by a feed pump 4 and pumped via a pressure or pulsation damper 5 and a check valve 6 to a metering valve 7 of a mixing chamber 8. The metering valve 7 meters the

required urea-water solution into a mixing space, described hereinafter with reference to Fig. 4, of a mixing chamber. An overflow quantity of urea-water solution if it occurs can be returned to the urea tank 1 via a pressure regulator 10 and a check valve 11 through a return line 1d. Venting can be performed via a venting circuit, which has a venting valve 12.

[0028] Reference numeral 20 also indicates a compressed air container, from which compressed air can be introduced into the mixing chamber via a compressed air line 2a with a pressure limiter 21, a 2/2-way valve 22, and a check valve 23.

[0029] In the mixing chamber, by subjecting the urea-water solution to compressed air, an aerosol and a wall film are created, which are introduced into a catalytic converter 30 via an aerosol line 25. A control unit 40 picks up signals received from a higher-order engine control unit via a CAN data line 41, along with the signals of pressure, temperature and fill level sensors 50-55, which are known per se and will not be explained further here. From this information, the control unit 40 calculates a urea metering quantity that is to be added to an exhaust gas flowing through the catalytic converter 30. The connection (not shown) for the voltage supply and, as already described, the control unit data line (CAN line) 41 are located on the control unit 40.

[0030] With the aid of the magnet valves described, the control unit 40 regulates the pressure in the compressed air

line and furthermore monitors the urea-water solution pressure. The control unit 40 detects deviations and errors, stores them in memory, and causes them to be displayed by means of a diagnostic device (not shown) on the PC. A function display (also not shown) indicates any system error. The function display also contains the system operation lamp and a fuel gauge.

[0031] All the components shown, except for the control unit 40, urea tank 1 and air supply container 20, are secured in the described embodiment of the apparatus of the invention to a central plastic block, of the kind shown in Figs. 2-4, or can be at least partly integrated with such a block. The central plastic block is identified by reference numeral 60 in Figs. 2-4. The plastic block 60 can be built in, with all the components secured to or integrated in it, into a housing (not shown), which in particular is in two parts. Reference numeral 71 also indicates a control unit cap that can be secured to the housing. The housing can be fixed at a suitable point, for instance using securing bores 72.

[0032] The principle according to the invention for securing metering system components to a central block, or integrating them with such a block, will now be described in further detail in conjunction with Figs. 2-4.

[0033] In Fig. 2, the air pressure regulating valve 22, the feed pump 4, a connection 1b for the urea line 1a, a

connection 20b for the air delivery line 20a, a connection 25a for the aerosol line 25, and further components, whose function is known per se and therefore requires no further explanation, can be seen in the form of components mounted on the block 60.

[0034] In Fig. 3, components that are the same or similar to those already described in conjunction with Figs. 1 and 2 are identified by the same reference numerals. In Fig. 3, for instance, the urea delivery connection 1b, an integrated air delivery line 20a, an air pressure regulator 22a corresponding to the valve 22 in Fig. 1, a pressure regulator 10a corresponding to the pressure regulator 10 of Fig. 1, and a pressure sensor 50a corresponding to the pressure sensor 50 of Fig. 1 and a pressure damper 5a corresponding to the pressure damper of Fig. 1 can all be seen. Also visible in Fig. 3 is a connection 1e for the urea return line 1d.

[0035] In Fig. 4, the following components in particular can be seen, which are placed in the central plastic block 60: the compressed air line connection 20b, the aerosol line connection 25b, and the urea line connection 1b. A compressed air line placed in the block 60 is identified by reference numeral 20b'. From here, compressed air flows via a further line segment 20c and an annular gap into a mixing space 8a of a mixing chamber 8. Also visible here is an integrated urea line 1a, by way of which the delivered urea can be introduced,

via the metering valve 7 already mentioned in conjunction with Fig. 1, into the mixing space 8a for forming an aerosol.

[0036] In Fig. 5, a further preferred embodiment of the plastic block 60 of the invention is schematically shown. Here, for the sake of simplicity, no attempt has been made to show the components integrated with the plastic block 60. In Fig. 5, all that can be seen are two electrodes 160, which can be subjected to voltage via a voltage source 161, for instance the vehicle battery of a utility vehicle. The control unit that regulates the voltage supply to the electrodes 160 is not shown individually here.

Claims

1. An apparatus for metering a reducing agent, in particular a urea or a urea-water solution, having means (20a, 20b, 21, 22, 23, 55) for metered air delivery into a mixing chamber (8), means (1a, 2, 3, 4, 5, 6) for metered reducing agent delivery into the mixing chamber (8), means (8a) for forming an aerosol using the components delivered to the mixing chamber (8), and means for metered dispensing of the aerosol into an aerosol line (25),

characterized in that

the means (20a, 20b, 21, 22, 23, 55) for the metered air delivery, the means (1a, 2, 3, 4, 5, 6) for the metered reducing agent delivery, and the mixing chamber (8) are all secured at least partly to a block (60) of a plastic or a metal material or are integrated with it.

2. The apparatus of claim 1, characterized in that the block (60) is produced from an electrically conductive plastic.

3. The apparatus of one of claims 1 or 2, characterized in that the block (60) is produced from a plastic to which electrically conductive particles are added.

4. The apparatus of one of the foregoing claims, characterized in that the block (60) is embodied with electrodes (160) that can be subjected to a voltage.

5. The apparatus of claim 1, characterized in that the block (60) is produced from aluminum.

6. The apparatus of one of the foregoing claims, characterized in that the means for air delivery have an air medium delivery line (20a), an air pressure regulating valve (22), an air pressure sensor (55), a check valve (23), and a metering valve (7).

7. The apparatus of one of the foregoing claims, characterized in that the means for reducing agent delivery have a reducing agent delivery line (1a), a pump (4), a pressure regulator (10), a pressure damper (5), as well as a metering valve and at least one check valve (2).

Abstract

An apparatus for metering a reducing agent, in particular a urea or a urea-water solution, having means for metered air delivery into a mixing chamber, means for metered reducing agent delivery into the mixing chamber, means for forming an aerosol using the components delivered to the mixing chamber, and means for metered dispensing of the aerosol into an aerosol line, in which the means for the metered air delivery, the means for the metered reducing agent delivery, and the mixing chamber are all secured at least partly to a block of a plastic or a metal material or are integrated with it.

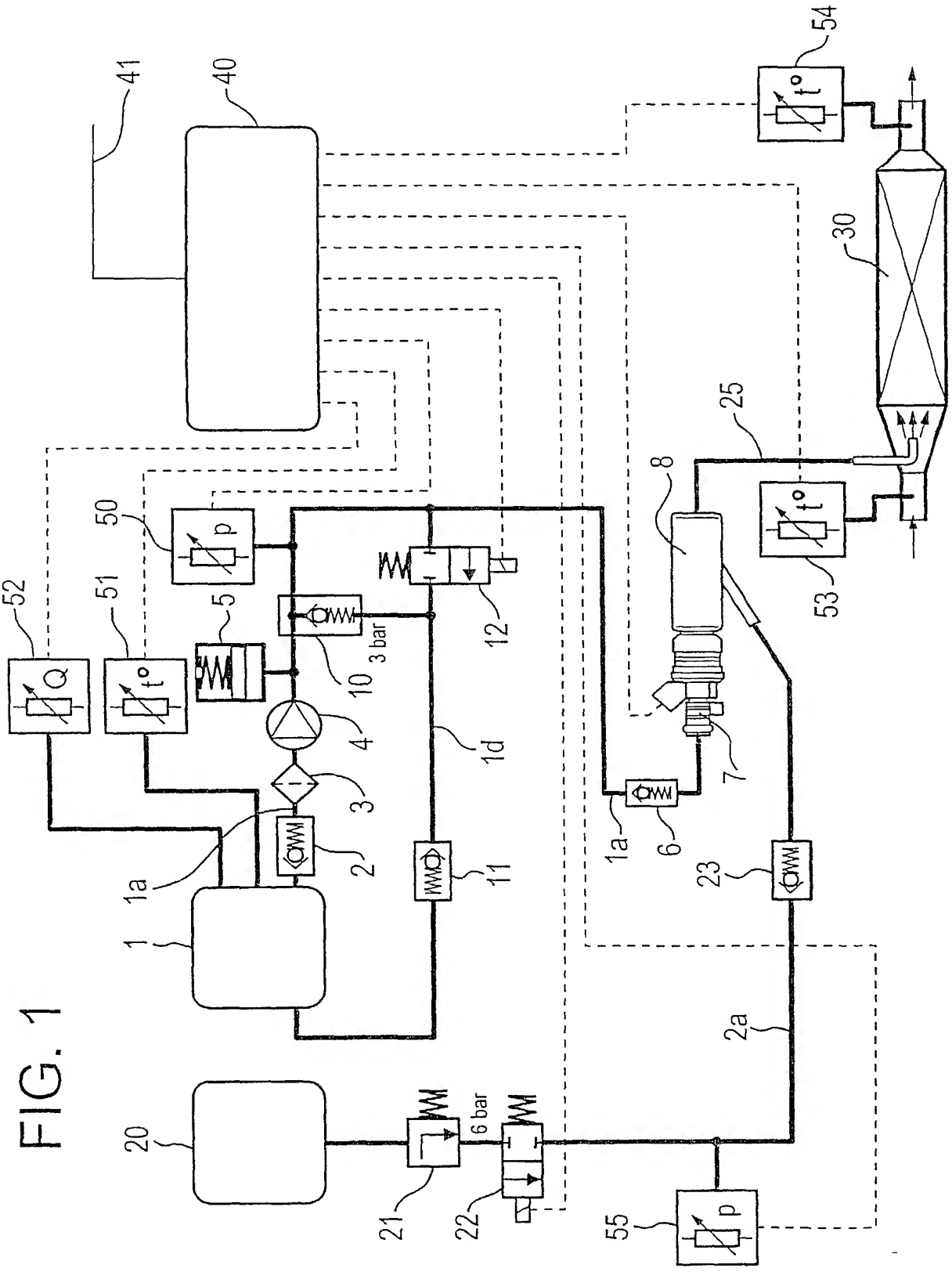
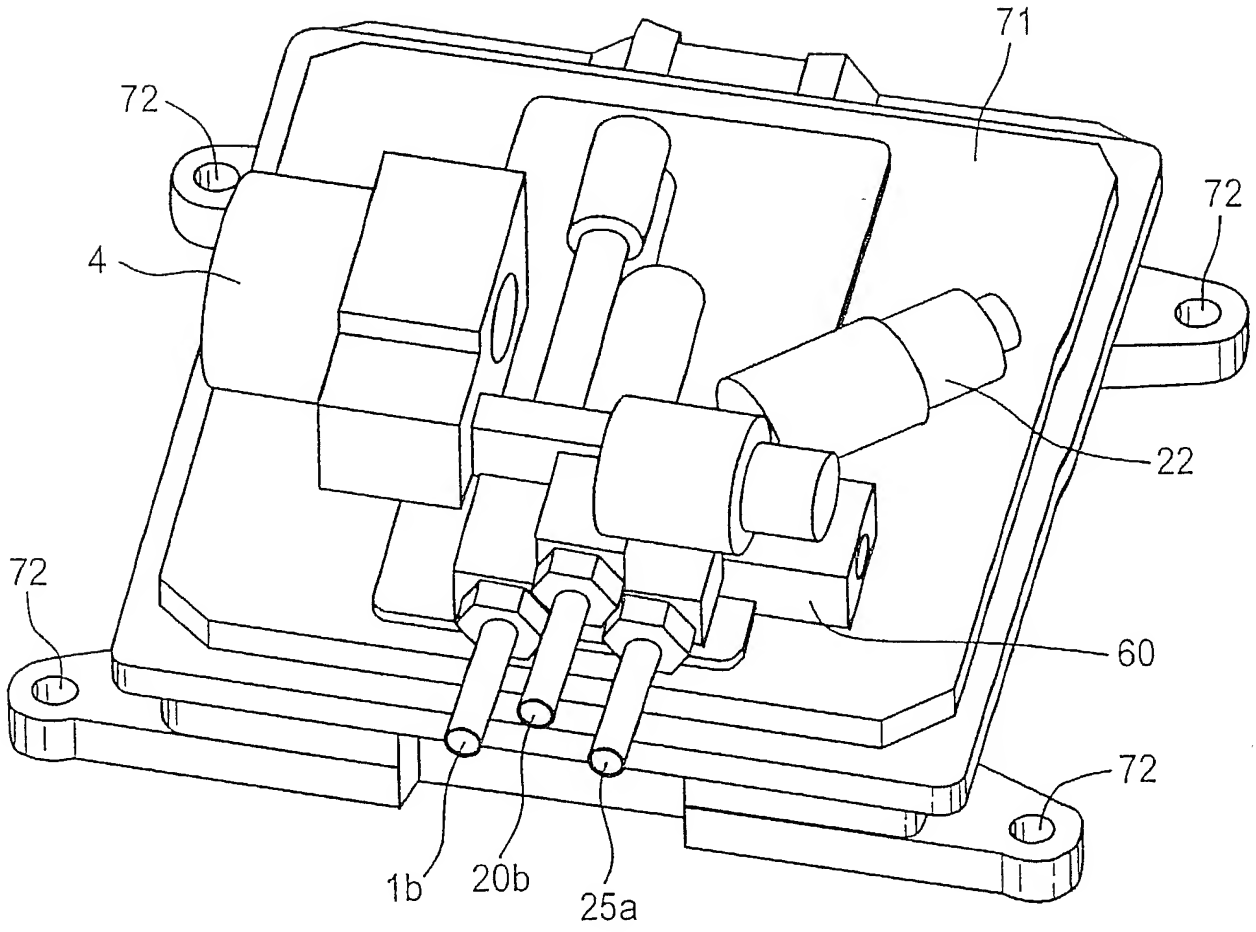

41
40
54
t°
30
25
8
50
p
52
51
Q
t°
5
3 bar
10
12
4
1d
3
2
1a
11
1
1a
6
7
53
t°
23
2a
20
6 bar
21
22
55
p

FIG. 1

FIG. 2



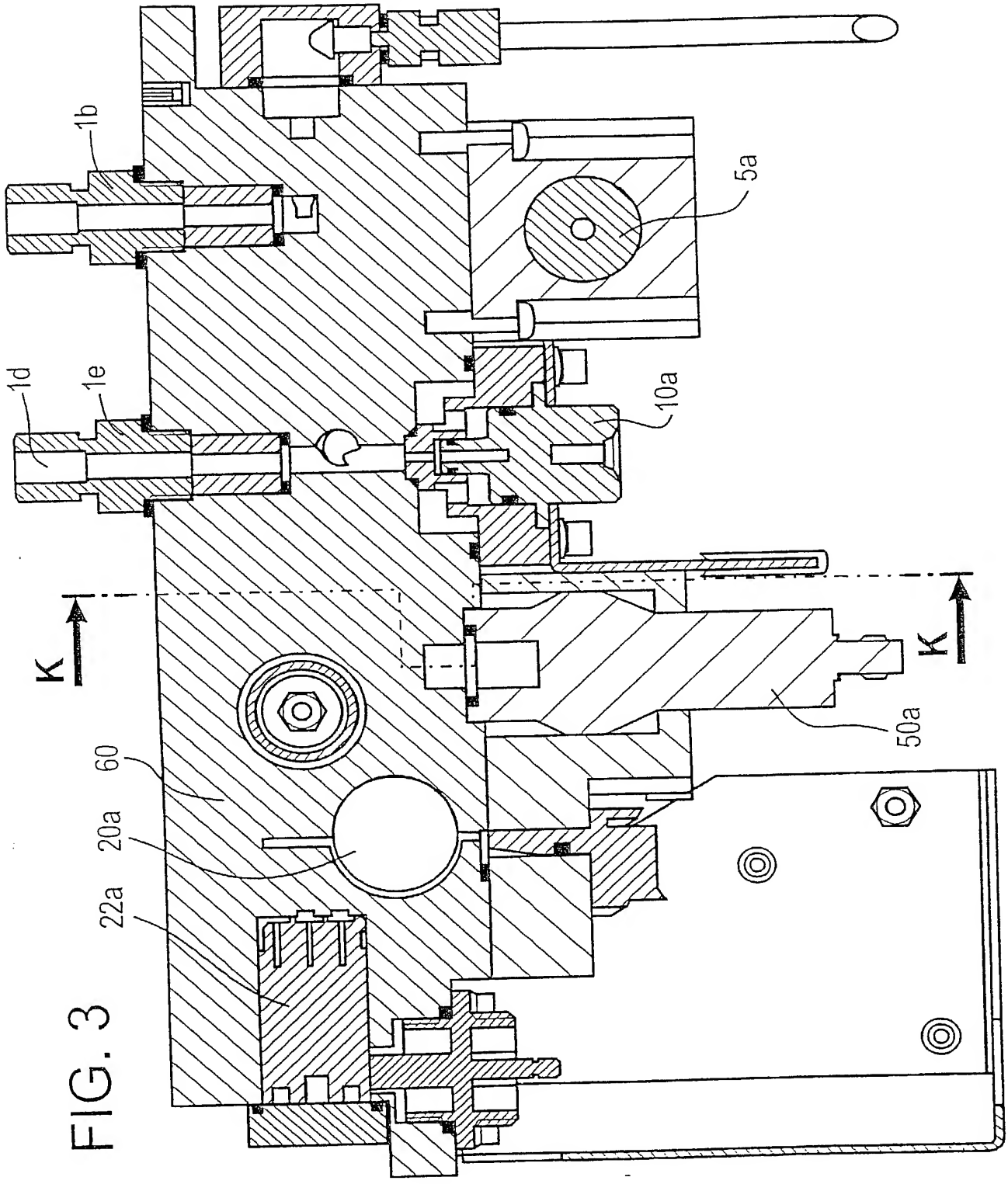


FIG. 3

FIG. 4

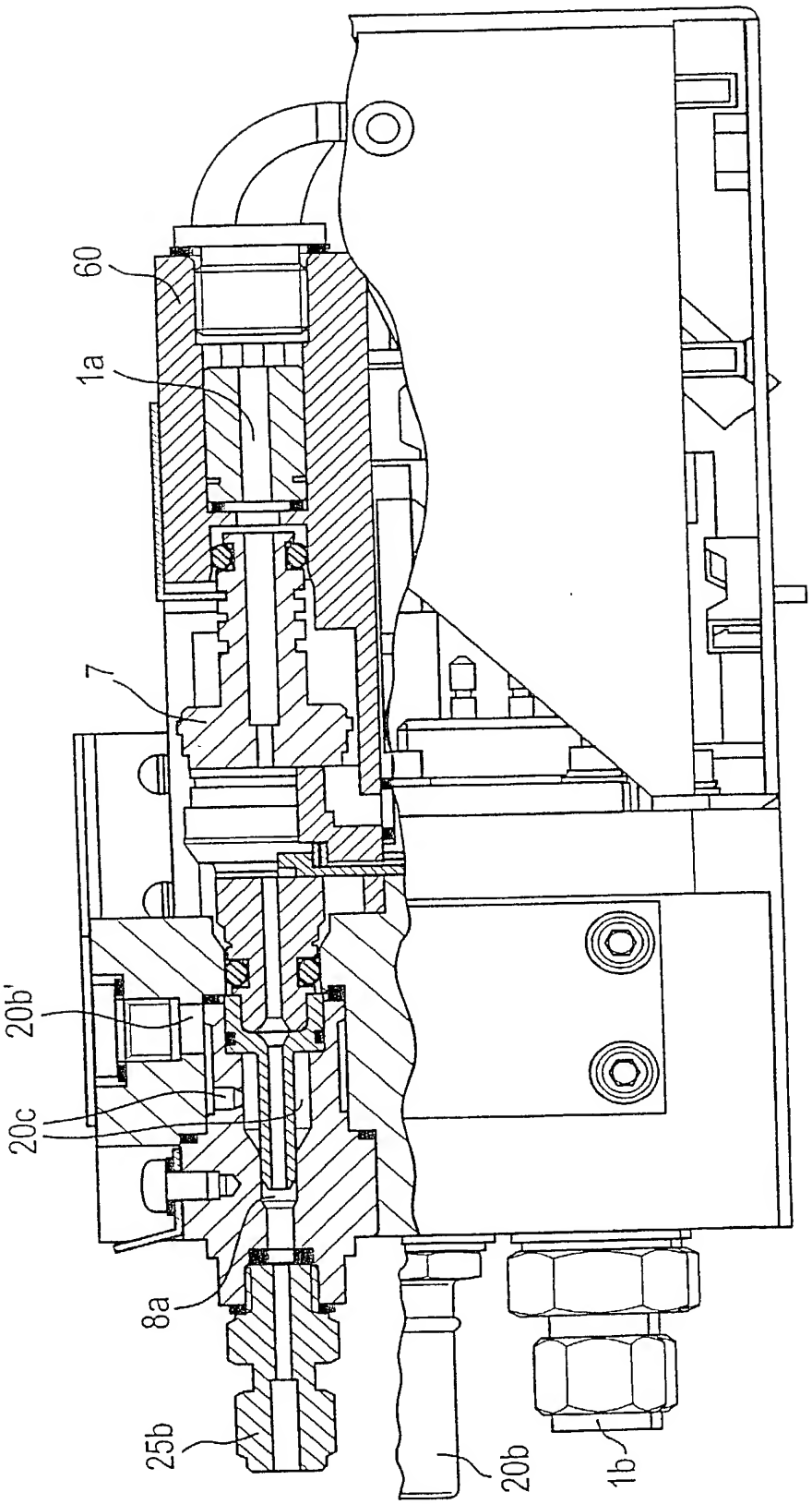
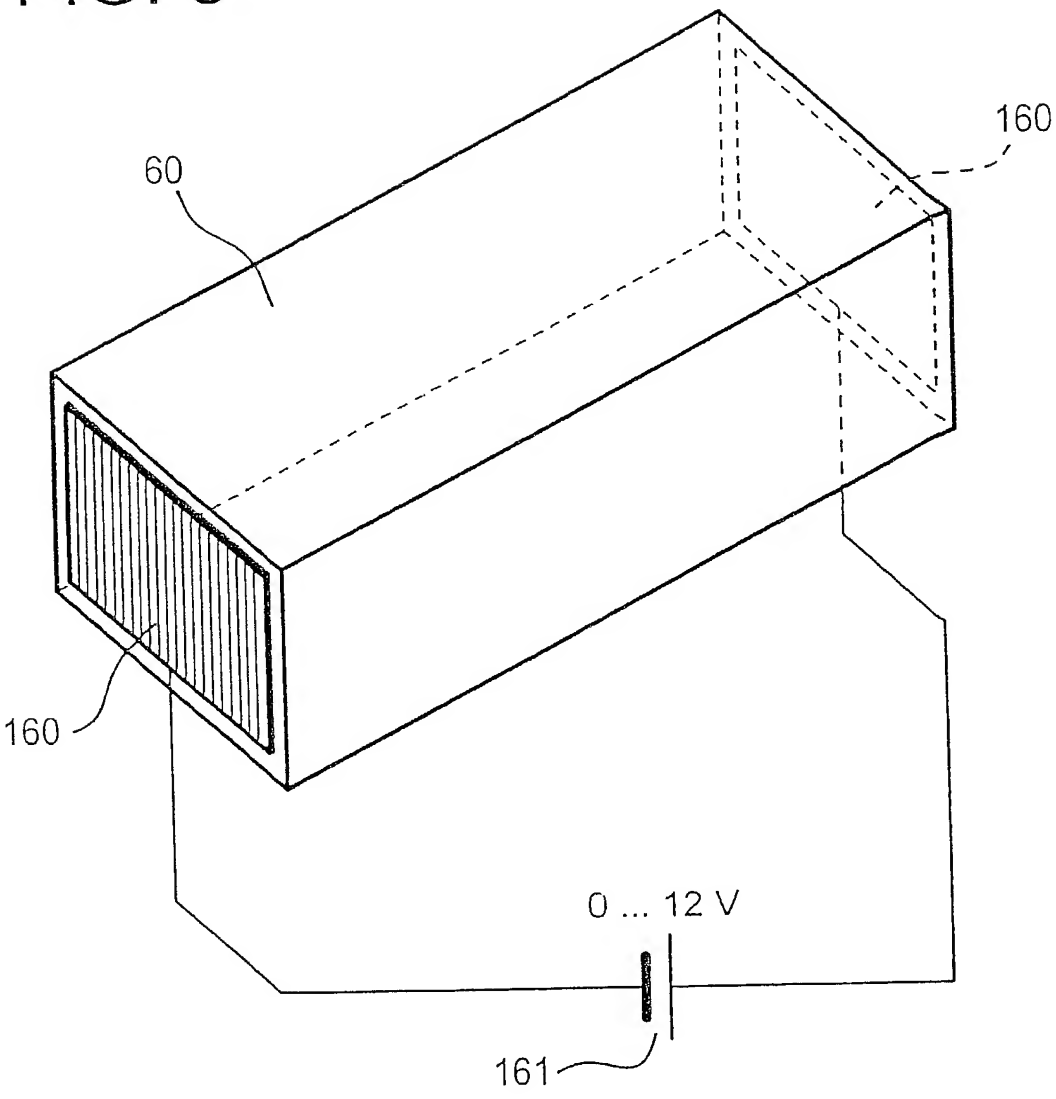


FIG. 5



Docket No.
R.36040-1

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

APPARATUS FOR METERING A REDUCING AGENT

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on **08 June 2000** as United States Application No. or PCT International Application Number **PCT/DE 00/01877**

and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Claimed
1 99 28 551.9	Germany	22 June 1999	☒
(Number)	(Country)	(Day/Month/Year Filed)	
1 99 46 900.8	Germany	30 September 1999	☒
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	

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